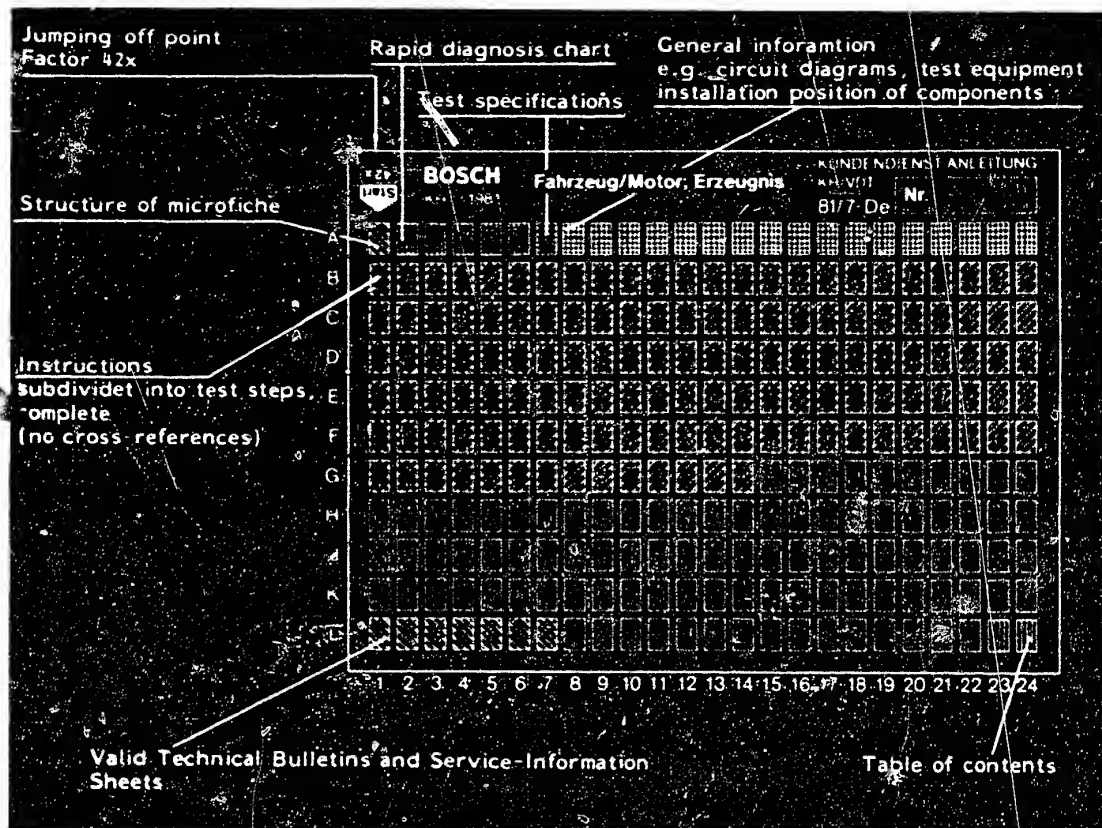


## Structure of microfiche



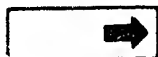
1. Read from left to right

2. Title of microfiche (appears on each coordinate)

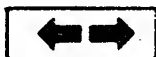
<b>E16</b>	Product/assembly/test step	
	Vehicle/engine	

Coordinate

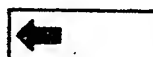
3. Limits of section



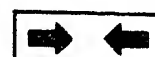
Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

**C6**

**A1**

Trouble-shooting program



## 1. Rapid diagnosis chart

The following rapid diagnosis chart makes it possible for the experienced expert to quickly check the electrical/electronic part of the ignition system using normal workshop test equipment.

The rapid diagnosis chart contains the following information:

- Customer complaint
- Cause of the trouble
- Test instructions (if no coordinate given on the right, further possibilities for testing are indicated).
- Coordinates for detailed trouble-shooting.

If detailed information and instructions on trouble-shooting are necessary, always proceed according to the trouble-shooting program starting on coordinate B 1.



# Rapid diagnosis chart

Customer complaint (symptom of trouble)

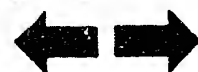
1. Starting motor operates, but engine fails to start
2. Rough idling
3. Poor throttle response
4. Engine lacks power
5. Misfiring
6. Fuel consumption too high
7. Engine pings when accelerating
8. Backfiring
9. Engine becomes too hot

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
●	●	●	●	●	●		●		Spark plugs defective	Assess using ignition oscillograms or remove spark plug and make visual examination.	-
●	●	●	●	●	●	●	●	●	Ignition timing incorrect	See Autodata test specifications	-
●	●	●	●	●					Shunt on secondary side	Assess ignition coil, ignition distributor, ignition harness and spark plug using ignition oscillogram or make visual examination.	-
●	●	●	●	●					Open circuit on secondary side	Assess ignition coil, ignition distributor, ignition harness and spark plug using ignition oscillogram, or test for continuity using ohm-meter	-
●									Open circuit on primary side	Test voltage supply to trigger box or test primary circuit	C 3
●	●	●	●	●					Ignition coil defective	Make visual examination, electrical test	B 5

**A 3**

Rapid diagnosis chart

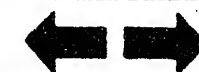
BMW 80 →



**A 4**

Rapid diagnosis chart

BMW 80 →



# Rapid diagnosis chart

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start
2. Rough idling
3. Poor throttle response
4. Engine lacks power
5. Misfiring
6. Fuel consumption too high
7. Engine pings when accelerating
8. Backfiring
9. Engine becomes too hot

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
		●	●	●	●				Interference-suppression resistors defective	Assess using ignition oscillogram or perform resistance measurement	-
	●	●	●		●	●	●	●	Centrifugal advance defective	See Autodata test specifications	-
		●	●		●	●		●	Vacuum advance defective	See Autodata test specifications	-
●									Trigger box defective	Test final stage and primary voltage	B 11
●									Ignition distributor pickup system defective	Pick-up resistance, pick-up winding short-circuit to ground, check pick-up system for mechanical damage.	C 1
●	●	●	●	●					Engine-speed limiter defective	Test cut-out speed, or perform visual examination.	
●									Firing sequence incorrect	See Autodata test specifications	

**A5**

Rapid diagnosis chart  
BMW 80 →



**A6**

Rapid diagnosis chart  
BMW 80 →

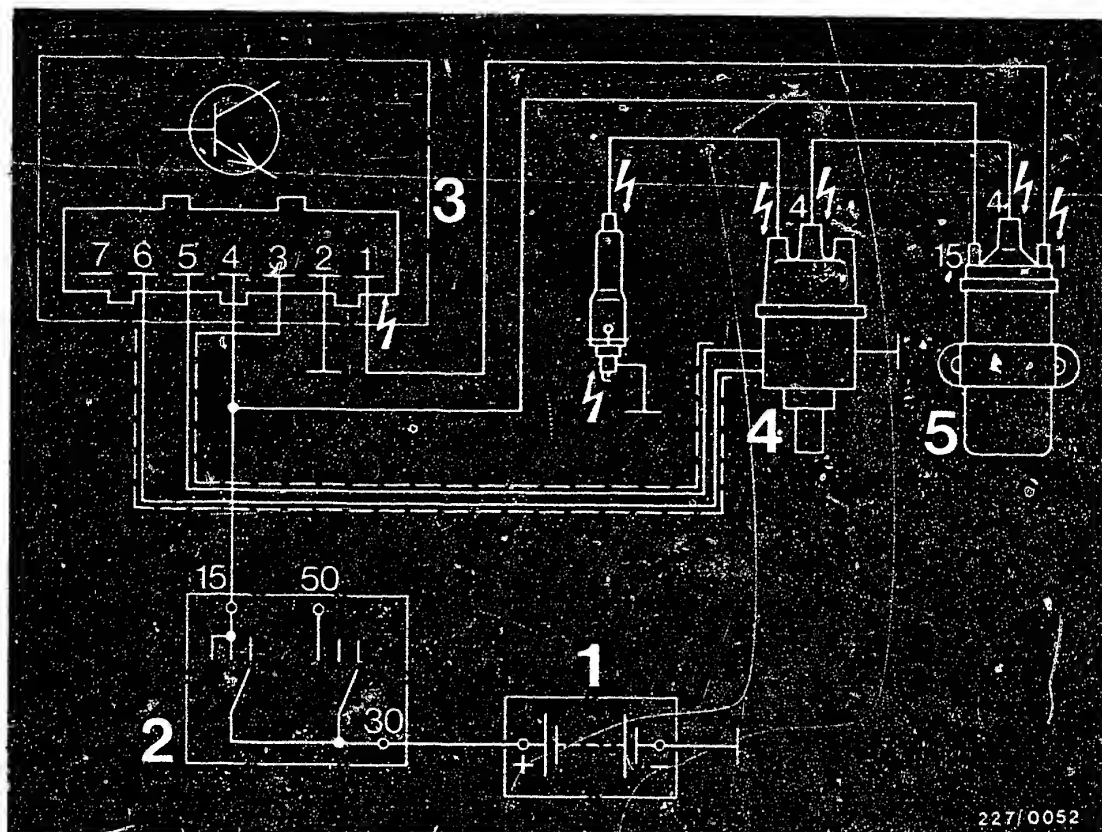


## 2. Test specifications

Ignition coil, primary	0.7...1.0 $\Omega$	<b>B5</b>
Ignition coil, secondary	6.7...9.6 $\Omega$	
Voltage supply, trigger box	12 ...14 V	<b>B9</b>
Voltage supply, ignition coil	10 V	
Final stage with ignition "ON"	0 V	<b>B11</b>
Primary voltage, at idle	300...350 V	
Pick-up resistance	890...1300 $\Omega$	<b>C1</b>
Pick-up winding to ground	$R = \infty$	

For adjustment values for ignition, idle speed, exhaust gas, valve clearances etc., refer to Autodata Test Specifications.



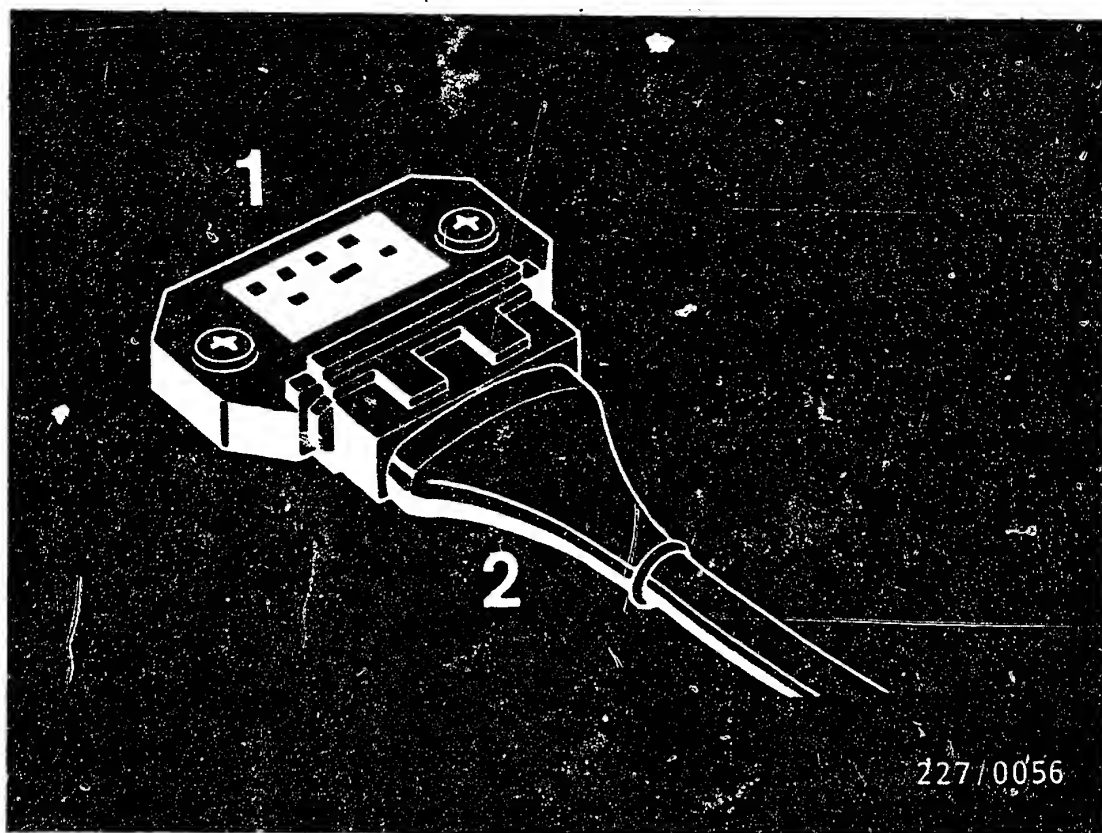


Kl. = Terminal

- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

⚡ = Dangerous voltages (400 V - 25 kV)

### 3. Electrical terminal diagram



227/0056

- 1 = TI-i trigger box
- 2 = Trigger-box plug

#### 4. Installation position of components

The trigger box is mounted on a heat sink in the engine compartment.

## 5. Necessary test equipment, aids

Motortester	MOT 002.00	0 684 000 200
Spark gap e.g. Ignition coil and condenser tester or Single spark gap	EFAW 106 A EF 1177/7	0 681 100 001 1 684 531 000
5 k $\Omega$ sleeve-type suppressor		0 356 500 001
Ohmmeter or e.g.	ETE 014.00 Pontavi Wh2	0 684 101 400 Commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400





## 6. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts or terminals are touched (both on the primary as well as the secondary sides).

In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

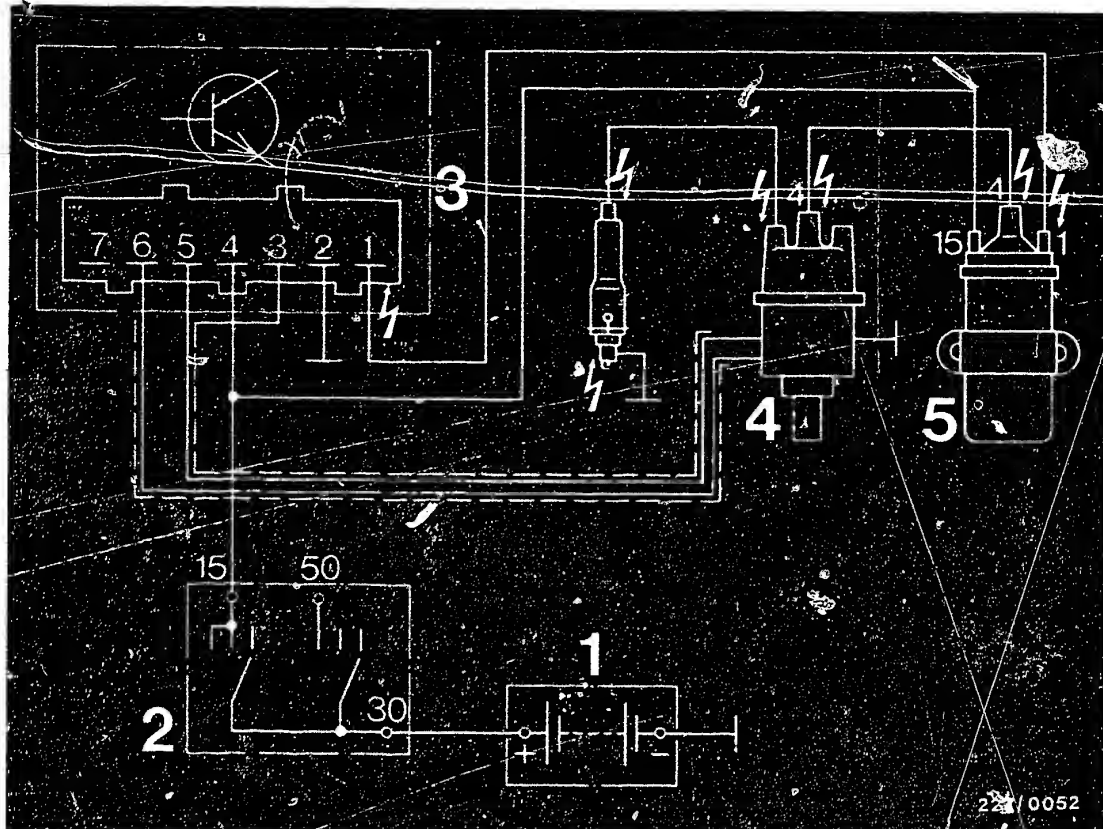
- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope, etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, H.T. ignition cable, etc.).



If, while testing the ignition system or during adjustment work on the engine (e.g. carburettor), it becomes necessary to switch on the ignition (switch on ignition or voltage source), the above-mentioned dangerous voltages occur over the entire system.


The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e.g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





Kl. = Terminal

- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

 = Dangerous voltages (400 V - 25 kV)

### Electrical terminal diagram

The dangerous locations are marked with danger arrows taking the example of the terminal diagram of an electronic ignition system.



7. Incorrect indication of engine speed, dwell angle and ignition point

In ignition systems with trigger boxes 0 227 100 111 (TI-i) with current limitation there may be an incorrect indication of engine speed, dwell angle and ignition point on testers.

For further details see Coordinates L 4 - L 8.



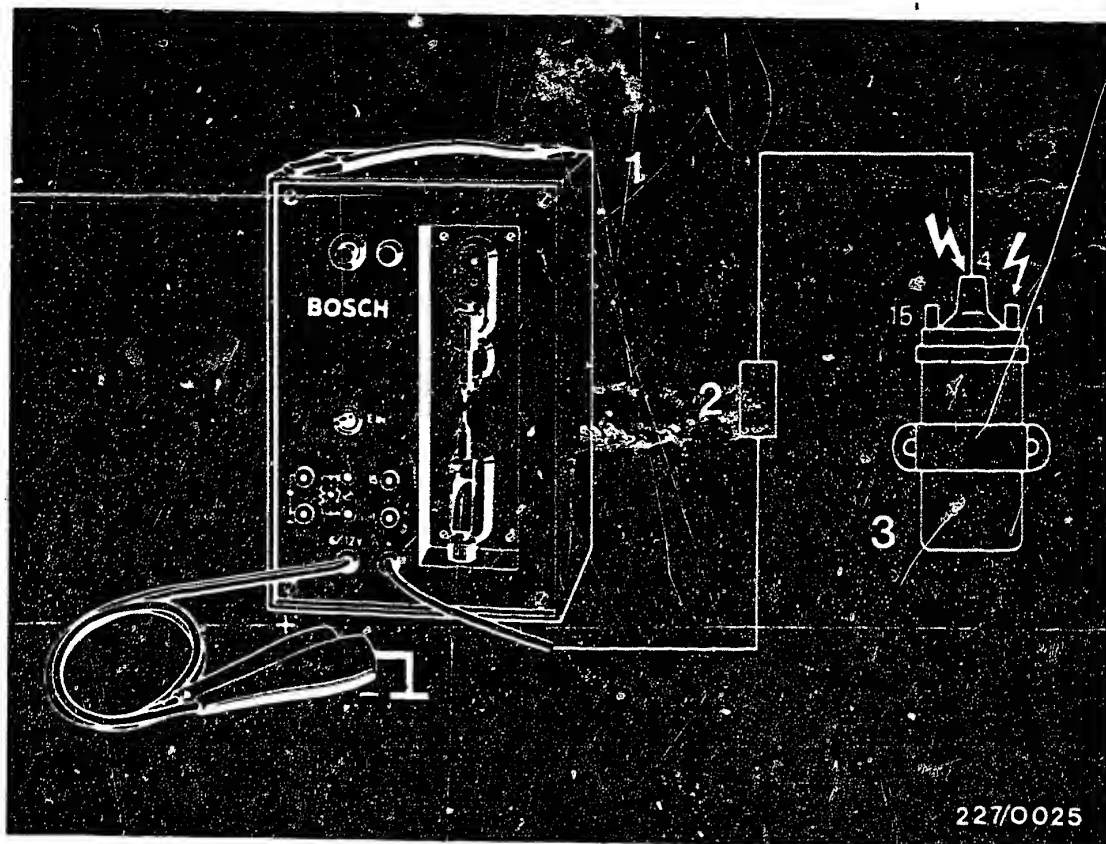
## 8. Important vehicle information

- During the compression test, either pull off the trigger-box plug or firmly connect terminal 4 of the ignition coil to ground using an extra cable (dangerous voltages, insulation damage at ignition coil, ignition distributor or ignition harness).


Note: The extra cable must be suppressed with at least 2 k $\Omega$ , e.g. with the interference-suppression sleeve (5 k $\Omega$ ) 0 356 500 001.

- Resistance measurements must only be performed with the ignition switched off or with the battery disconnected (measuring instrument defective).
- In order to prevent the trigger box from being irreparably damaged, the secondary side of the ignition system must have at least 2 k $\Omega$  interference suppression whereby the original distributor rotor with 1 k $\Omega$  interference-suppression resistor must be fitted (even in the case of radio and spark interference suppression do not use a 5 k $\Omega$  distributor rotor).





- 1 = Spark gap
- 2 = 5 k $\Omega$  sleeve-type suppressor
- 3 = Ignition coil

 = Dangerous voltages (400 V - 25 kV)

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 k $\Omega$  must be connected between the spark gap and ignition coil terminal 4, e.g. sleeve-type suppressor (5 k $\Omega$ ) 0 356 500 001.
- In the case of ignition distributors with engine-speed limitation the ignition distributor side terminal 4 must have 1 k $\Omega$  interference suppression. Operation without interference suppression will lead to the destruction of the trigger box.



- The holding springs of the distributor cap must not drop into the pickup system when the engine is being cranked and with the dust-protection cover removed.
- Do not disconnect the battery while the engine is running.
- Incorrect battery polarity will lead to the destruction of the trigger box and ignition coil.
- Do not use a starting aid with more than 16 V or a fast charger for starting.
- The specified ignition coil (see Part No.) must not be replaced with a different ignition coil.
- No suppression capacitor must be connected to ignition coil terminal 1 and terminal 15.
- Ignition coil terminal 1 must not be brought into contact with ground as a theft-proofing measure (ignition coil will be destroyed when ignition is switched on).
- No battery + or test lamp must be connected to ignition coil terminal 1 (trigger box will be destroyed).
- Ignition cable from ignition coil terminal 4 to ignition distributor terminal 4 must not be disconnected during operation.
- The line between the inductive-type pick-up and the trigger box must be screened (otherwise negative effect on the trigger-box function).



## 9. Trouble-shooting program

### Procedure

The trouble-shooting program is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanation of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "Yes", then proceed to the next test down.

If the answer to the question is "No", branch to the center row and carry out the tests given there.

Before testing, make sure of the following:

Battery fully charged, fuel system O.K., engine mechanically O.K. (e.g. compression, valve clearance etc.).

Ambient temperature/ignition system temperature 0° to +40°C (temperature has a considerable effect on measured values).





Beginning of trouble-shooting program

Starting motor operates, engine fails to  
start or misfires or lacks power.

Yes

Continued on B 3

**B2**

Trouble shooting program  
BMW 80 →



Yes

Test primary voltage or, if no oscilloscope available, check whether ignition spark across spark gap.

Primary voltage testing with oscilloscope.

Connect oscilloscope to ignition coil as per operating instructions.

Start engine.

Oscilloscope must indicate a primary voltage (of any value).

Ignition spark testing with spark gap.

Remove H.T. ignition cable terminal 4 from ignition coil.

Connect spark gap including sleeve-type suppressor ( $5\text{ k}\Omega$ ) to ignition coil. Adjust spark gap to 5 mm.

Start engine.

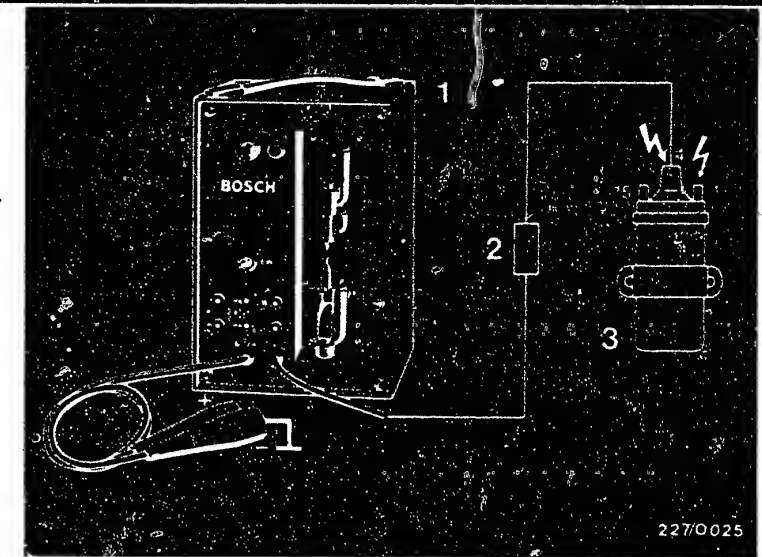
There must be sparks across the spark gap.

Primary voltage on oscilloscope or ignition sparks across spark gap?

No

If no primary voltage or no ignition spark, continue testing at C 1.

Tests from B 5 onwards not necessary.



- 1 = Spark gap
- 2 =  $5\text{ k}\Omega$  sleeve-type suppressor
- 3 = Ignition coil

⚡ = Dangerous voltages (400 V-25 kV)

Yes

Continued on B 5/6

**B 3**

Trouble-shooting program

BMW 80 →

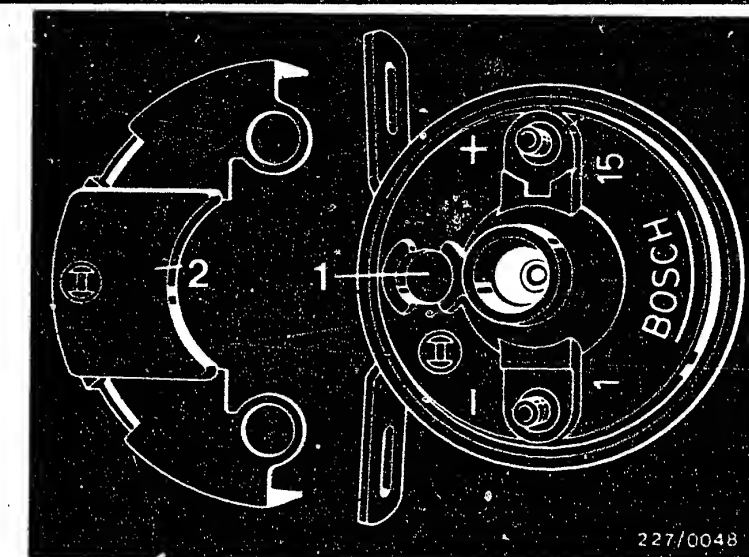
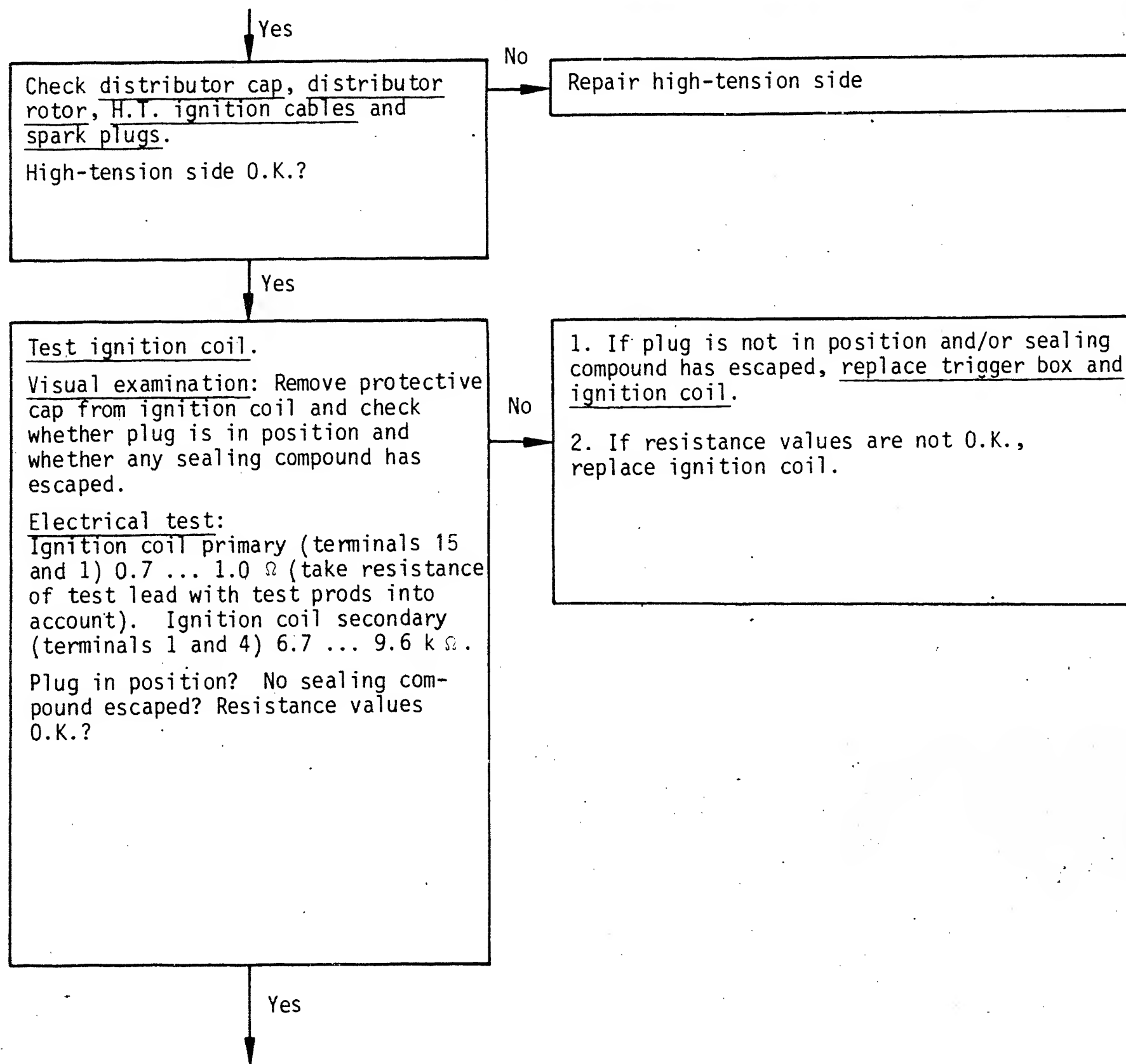


**B 4**

Trouble shooting program

BMW 80 →





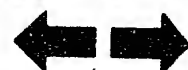
1 = Plug  
2 = Protective cap

Continued on B 7/8

**B5**

Trouble-shooting program

BMW 80 →

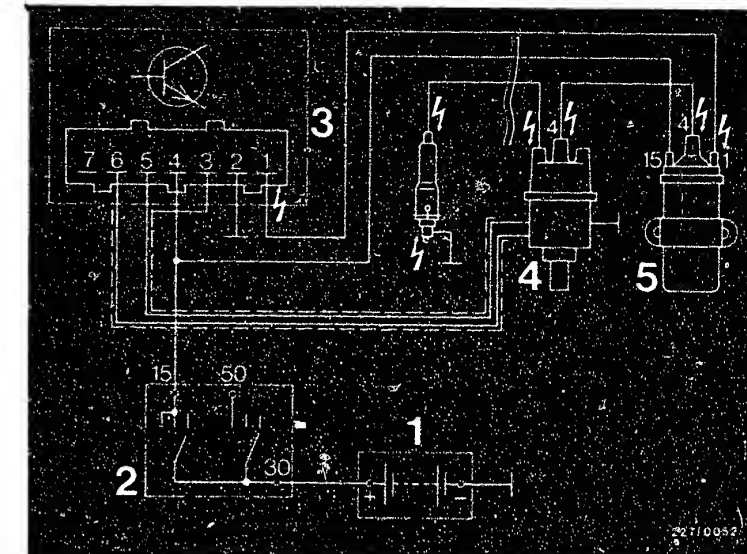
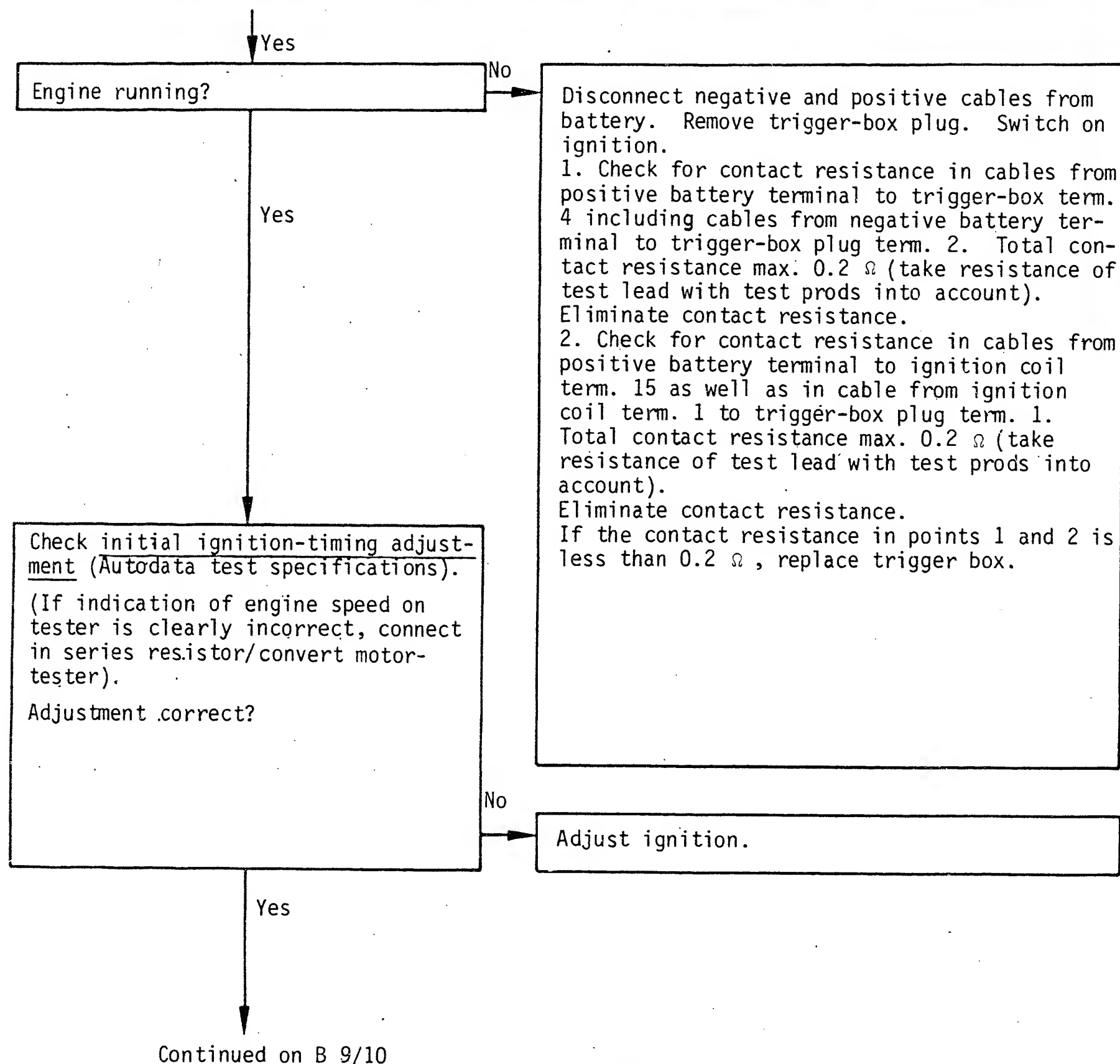


**B6**

Trouble-shooting program

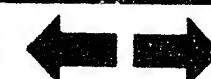
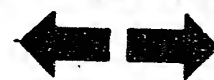
BMW 80 →

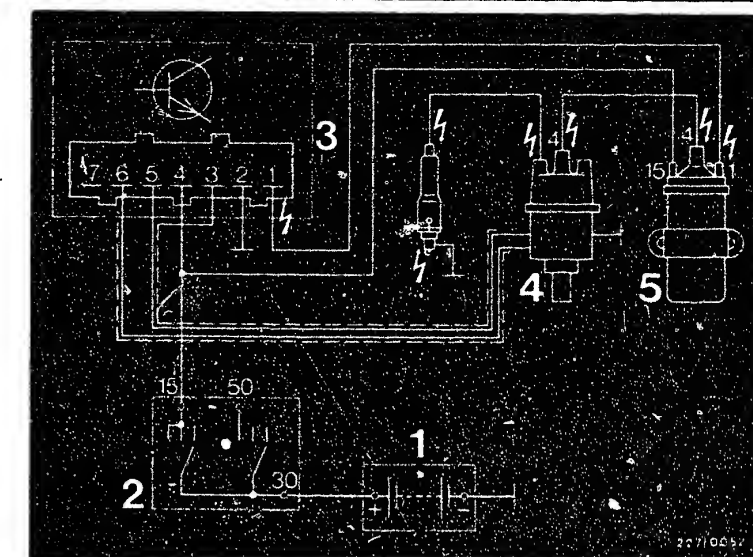
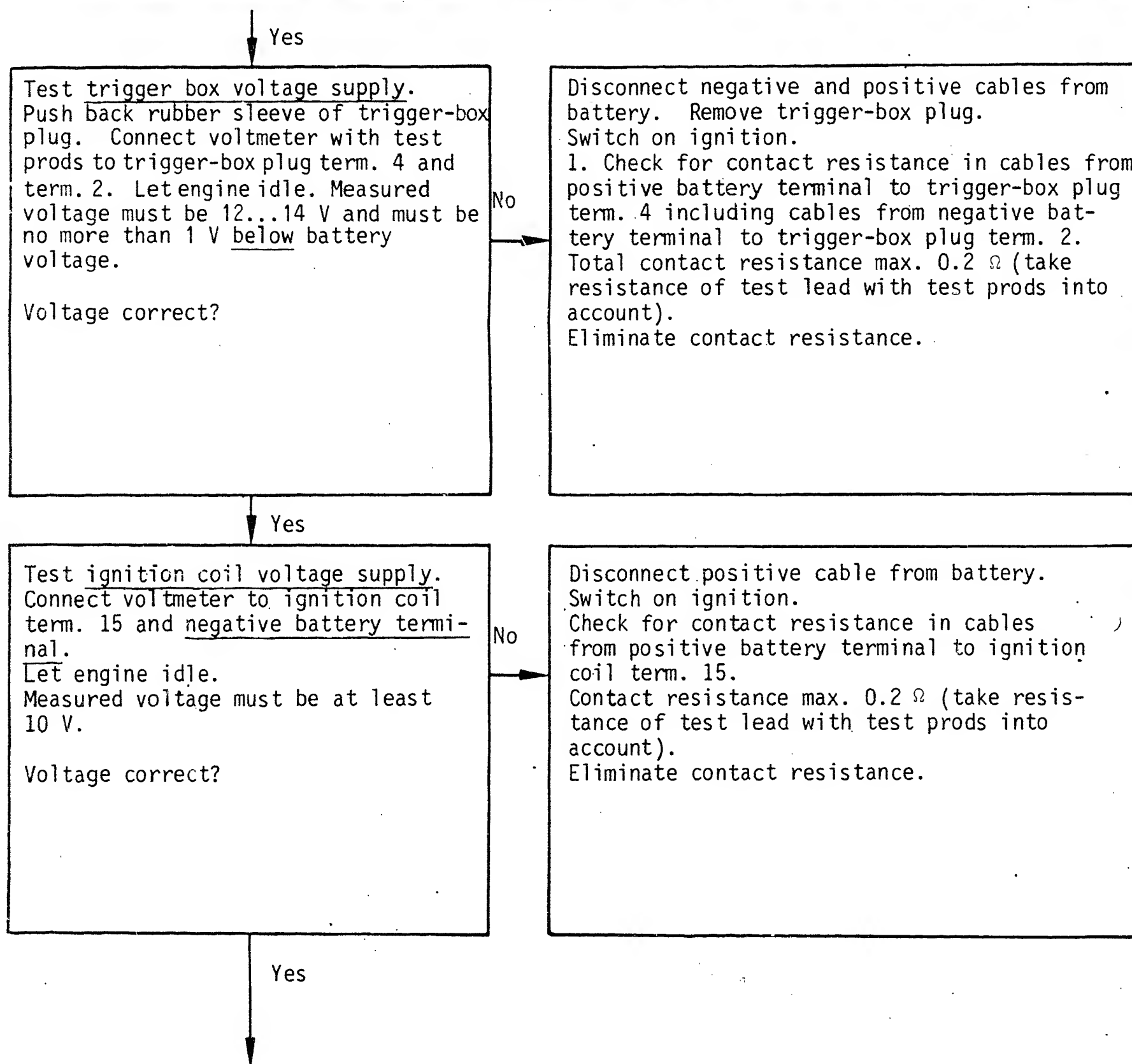




- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

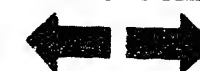
⚡ = Dangerous voltages  
(400 V - 25 kV)

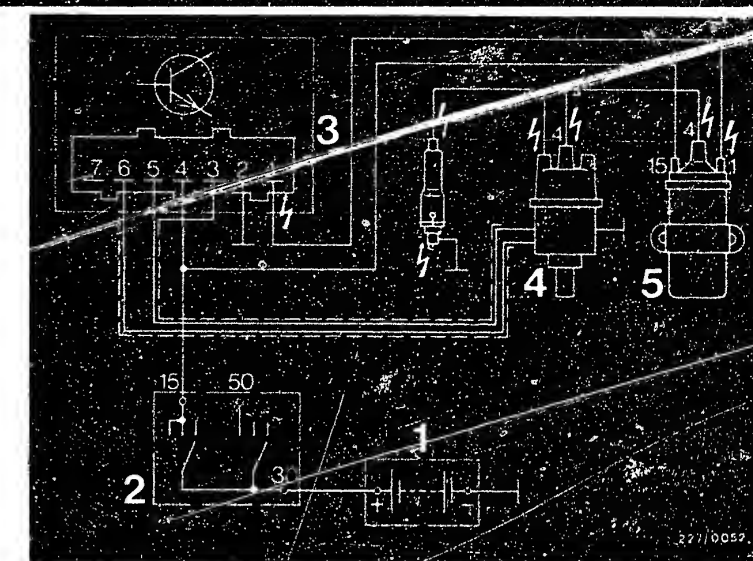
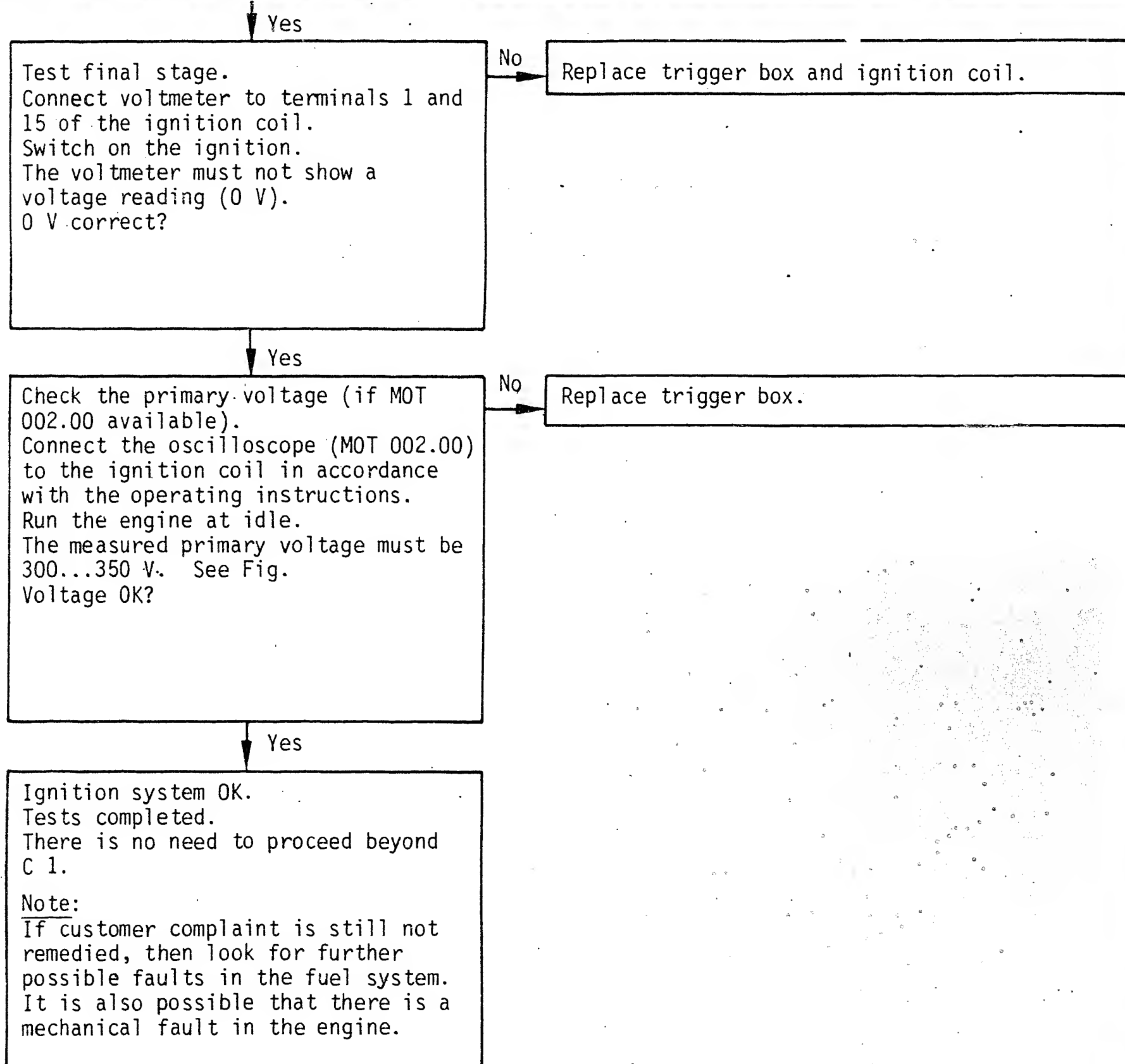




- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

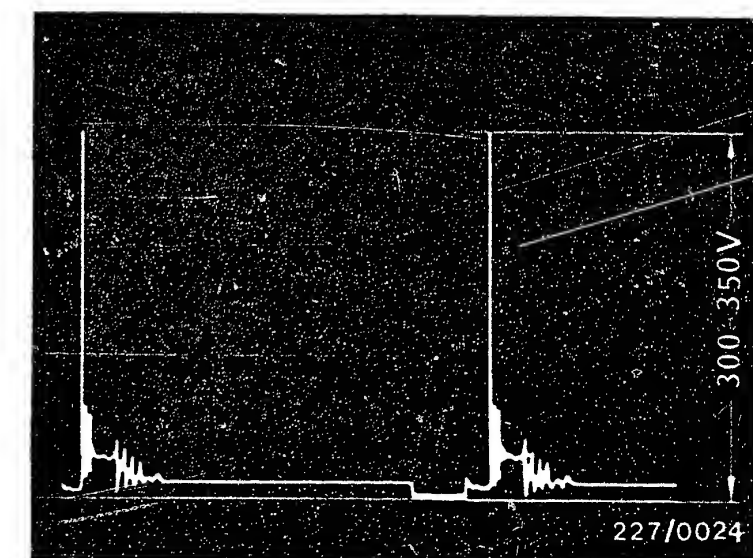
⚡ = Dangerous voltages  
(400 V - 25 kV)





- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

⚡ = Dangerous voltages  
(400 V ... 25 kV)



No primary voltage or no ignition spark.  
(Cont'd from B 4).

Yes

Measure the pick-up resistance  
(including pick-up leads) at the  
pulled-off trigger-box plug between  
terminals 5 and 6.  
Resistance = 890 ... 1300  $\Omega$ .

Resistance OK?

No

Replace the pick-up coil (ignition  
distributor) and/or pick-up leads.

Yes

Check the pick-up coil, including  
pick-up leads, at the pulled-off  
trigger-box plug for short-circuit  
to ground (terminal 5 or 6 shows  
short-circuit to vehicle ground).  
See Fig.  
Resistance  $R = \infty$  ?

No

Replace the pick-up coil (ignition  
distributor) and/or pick-up leads.

Yes

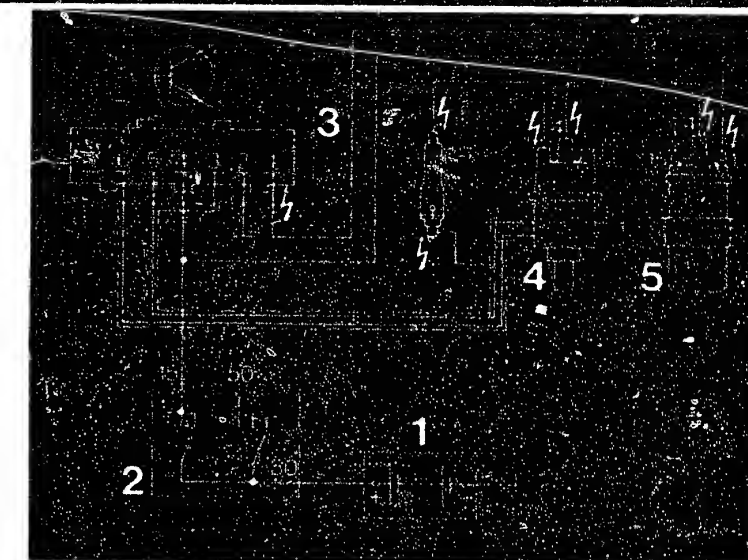
Check the pick-up system for  
mechanical damage.  
Visual check: Is there a gap  
between the rotor and the stator?  
Is the pick-up system OK?

No

Replace the pick-up system (ignition distrib.)

Yes

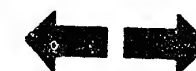
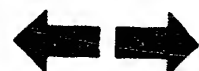
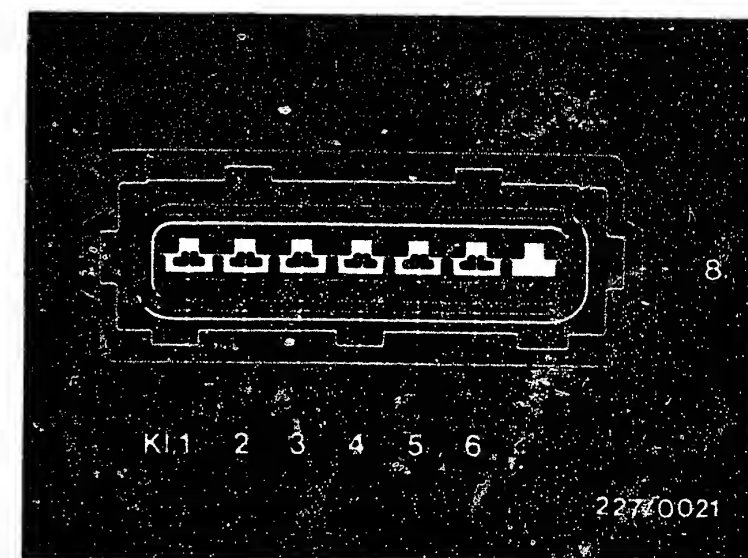
Continued on C 3/4



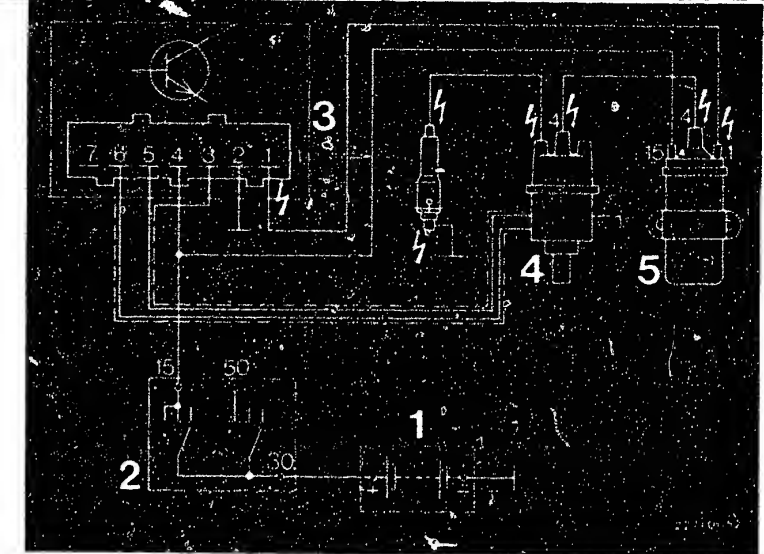
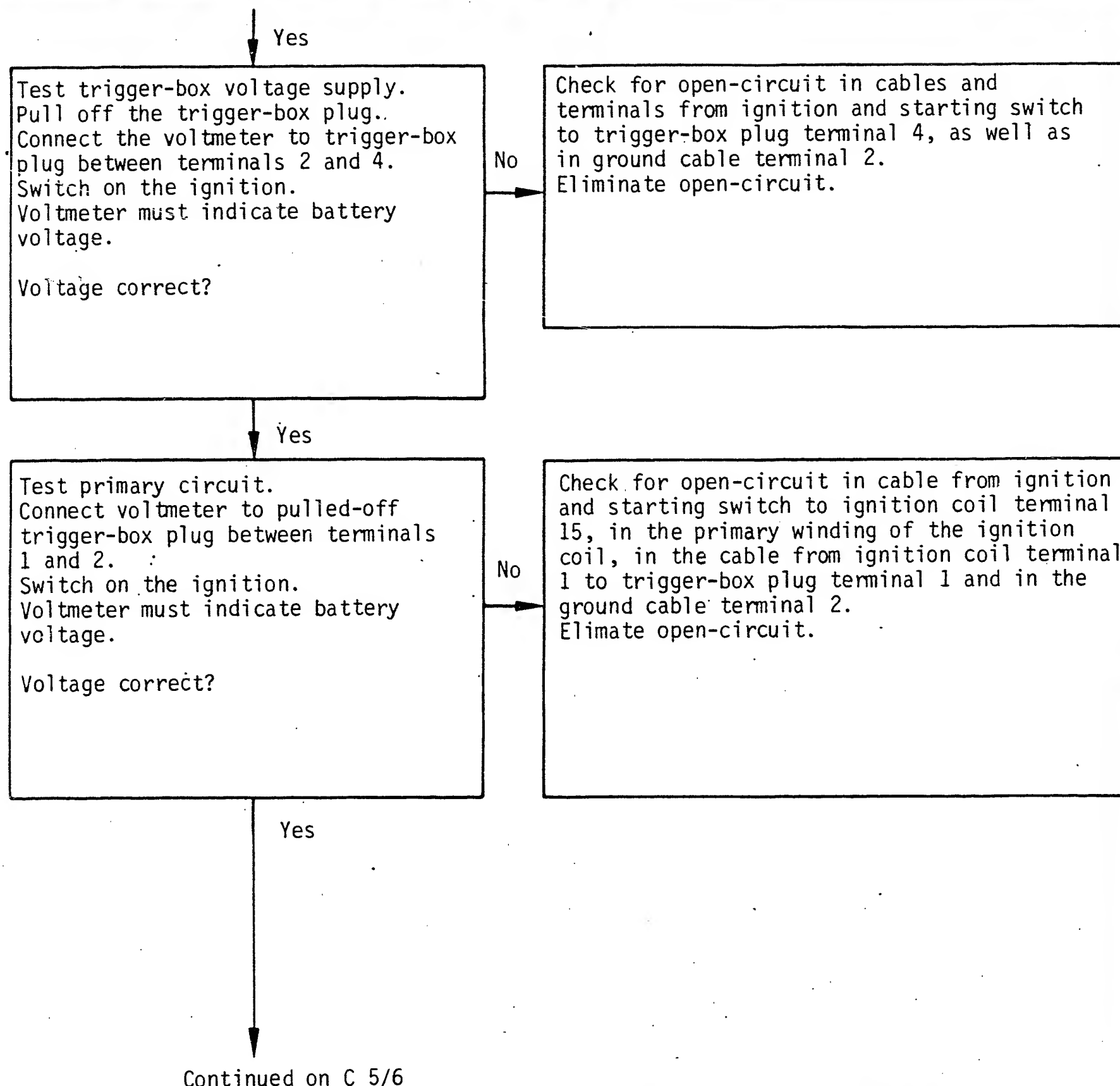
- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

⚡ = Dangerous voltages  
(400 V ... 25 kV)

8 = Trigger-box plug



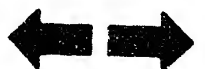
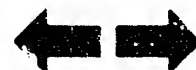
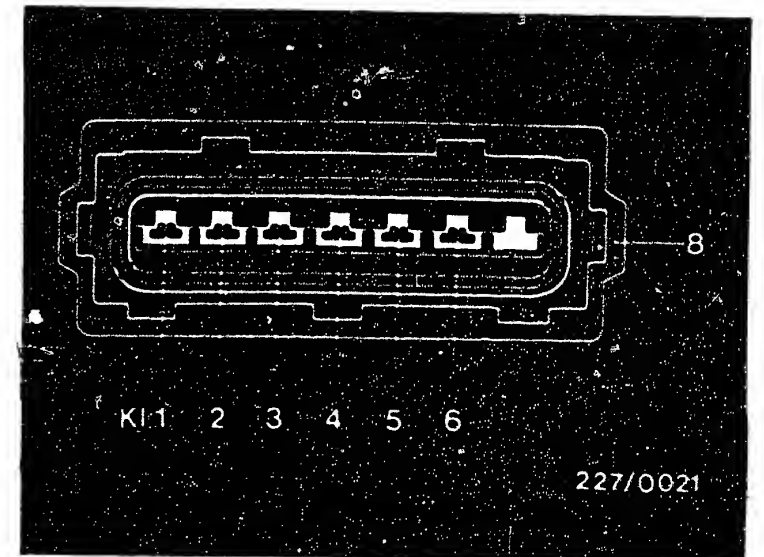




- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ignition distributor
- 5 = Ignition coil

⚡ = Dangerous voltages  
(400 V ... 25 kV)

8 = Trigger-box plug





Yes

### Test ignition coil.

Visual examination: Remove protective cap from ignition coil and check whether plug (see illustration) is in position and whether any sealing compound has escaped.

Electrical test: Ignition coil primary (term. 15 and 1)  $0.7...1.0 \Omega$  (take resistance of test lead with test prods into account).  
Ignition coil secondary (term. 1 and 4)  $6.7...9.6 k \Omega$ .

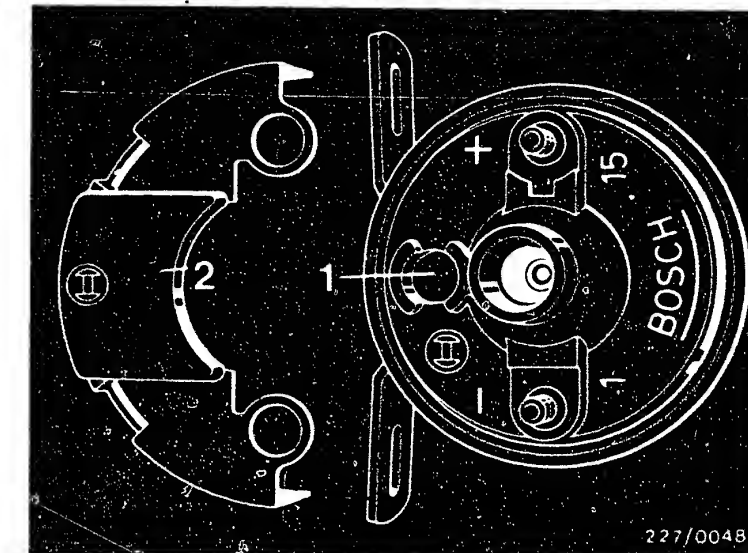
Plug in position? No sealing compound escaped?

Resistance values O.K.?

No

1. If plug is not in position and/or sealing compound has escaped, replace trigger box and ignition coil.

2. If resistance values are not O.K., replace ignition coil.



1 = Plug

2 = Protective cap

Yes

Replace trigger box.

Test completed.

Tests from B 5 not necessary.

### Note:

If customer complaint is still not remedied, then look for further possible faults in the fuel system, or the engine is not mechanically O.K.

C5

Trouble-shooting program

BMW 80 →



C6

Trouble-shooting program

BMW 80 →



# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

22

### Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only of individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

**BOSCH**

Geschäftsbereich KH Kundendienst Kfz-Ausrüstung  
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**L1**

Motor Vehicle Service Information

BMW 80 →

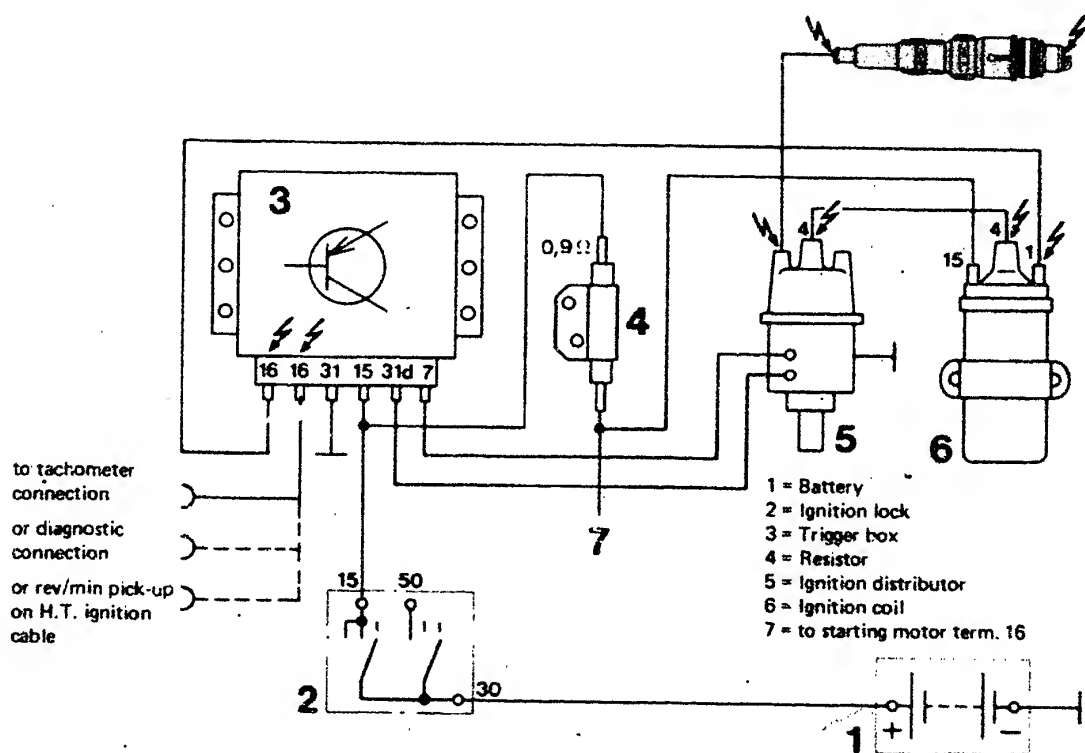


In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram

# After-sales Service

## Technical Bulletin

Only for use within the Bosch organization. Not to be communicated to any third party.

### BREAKERLESS TRANSISTORIZED IGNITION SYSTEM

22

#### Warranty note

VDT-I-227/103 En

Hybrid construction trigger boxes

3.1979

0 227 100 100 for ignition distributor  
with Hall generator (TCI-h)

0 227 100 102 for ignition distributor  
with induction-type  
pulse generator (TCI-i)

Apart from the well-known TCI trigger boxes 0 227 100 0.., trigger boxes of hybrid construction have been fitted as standard since 9.78 (Fig. 1).

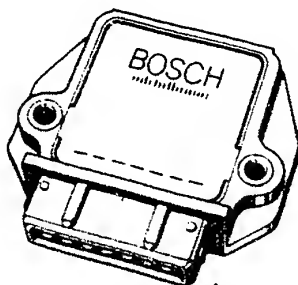


Fig. 1

#### Warranty procedure

If the complaints are justified, all these hybrid trigger boxes are to be sent, along with completed warranty documents, to your authorized representative for forwarding to the following address:

ROBERT BOSCH GMBH  
KH/LAV - Auspackraum

zur Weiterleitung an K1/VAK 21

D-7000 Stuttgart 30

This instruction remains valid until further notice.

**BOSCH**

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**L3**

Motor Vehicle Service Information

BMW 80→



# After-sales Service

## Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

INCORRECT DISPLAY OF ROTATIONAL SPEED AND  
DWELL ANGLE ONLY WITH TRIGGER BOXES  
0 227 100 ... (TCI-i, TCI-h) WITH CURRENT  
LIMITATION

VDT-I-Gen. 030 En  
6.80  
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

### 1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00}	Rotational-speed	KTE 001.00
001.01}	display O.K. with these	001.02
001.02	testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild-ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General-Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

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## 2. Test instructions

### 2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min<sup>-1</sup> to 1200 min<sup>-1</sup>).

It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

### Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohm

Part No. 0 227 900 002

or

1 ballast resistor 1.0 Ohm

Part No. 0 227 900 101

2 blade receptacles e.g.

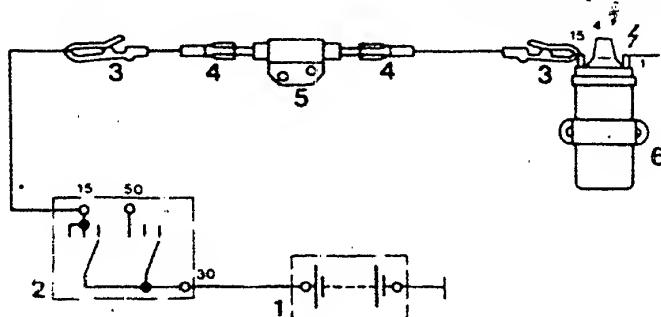
Part No. 1 901 355 881

approx. 0.2 m cable, 1.5 mm<sup>2</sup> e.g.

Part No. 6 210 150 150

2 insulated clips

Commercially available



1 = Battery

4 = Blade receptacle

⚡ approx. 400 V

2 = Ignition switch

5 = Ballast resistor

⚡ approx. 25 kV

3 = Clips

6 = Ignition coil

### 2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

### 2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.



# After-sales Service

## Motor Vehicle Service Information

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### MOTORTESTER CONVERSION

Incorrect display of rotational speed,  
dwell angle and ignition point  
only with trigger boxes  
0 227 100 ... (TCI-i, TCI-h) with current  
limitation

VDT-I-Gen. 032 En  
6.80

For additional information see VDT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268  
268 S 10  
269  
214 B  
AE 2000

### 1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

### 2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

### 3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

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#### 4. Test instructions

##### 4.1 Standard ignition systems

Switch position: "standard"

All other tester connections as per operating instructions.

##### 4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.



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